On a bullish note, shoulder season nuclear refueling and maintenance continues, bringing the amount of gas needed if it were to replace the outages to a 3.1 Bcf/d average for the week.

April futures fell 6.8¢ Friday to end the week at $2.753/MMBtu, down 4.2¢ for the week. In the oil market, May West Texas Intermediate crude fell 94¢, or 1.6% Friday, closing at $59.04 per barrel, but was up 22¢ for the week.

Meanwhile, Baker Hughes said the gas-focused rig count was down by one at 192, while oil-focused rigs were down by nine to 824. ■

Lisa Lawson, Houston

Robots and AI Aside, 'Workforce is Key' to Gas, Oil Industry Operations

The age of automation and digitalization in the oil and gas industry has arrived, but there is one key element that experts say will continue to play a major role: the human element.

"The workforce is the key. It always has been and always will be. Otherwise all of this technology is for nothing," Saudi Aramco Chief Technology Officer Ahmad al-Khowaiter told Energy Intelligence.

From nanobots to small robots, automation may soon be taking over maintenance duties on offshore rigs and platforms, inspecting pipelines and operating the world's first gas-fired power plant now being built in Japan with artificial intelligence (AI) (NGW Feb.11'19).

In this mix are also the applications capable of analyzing mounds of data or making thousands of calculations in a single instance. Caglayan Arkan, global lead for manufacturing and resources at Microsoft, said digitalization "is a combination and roadmap of hundreds of use cases, and the speed of development and deployment is paramount to success for an oil and gas major."

That concept took a big leap forward this month with CeraWeek by IHS Markit as the backdrop. That Houston conference is where the company Maana unveiled a collaboration with Microsoft to help oil and gas industry companies accelerate their digital transformation. The collaboration integrates Maana's Knowledge Platform with Microsoft Azure and makes Azure services and tools available to all Maana customers and application developers.

Maana founder and CEO Babur Ozden told Energy Intelligence that "as experimentation with big data led to digital transformation journeys, we started seeing more and more industrial majors committing to the cloud to house their digital ambitions. Recognizing the inevitability of the cloud, in 2016 we rebuilt our platform, selecting Microsoft Azure and never looking back."

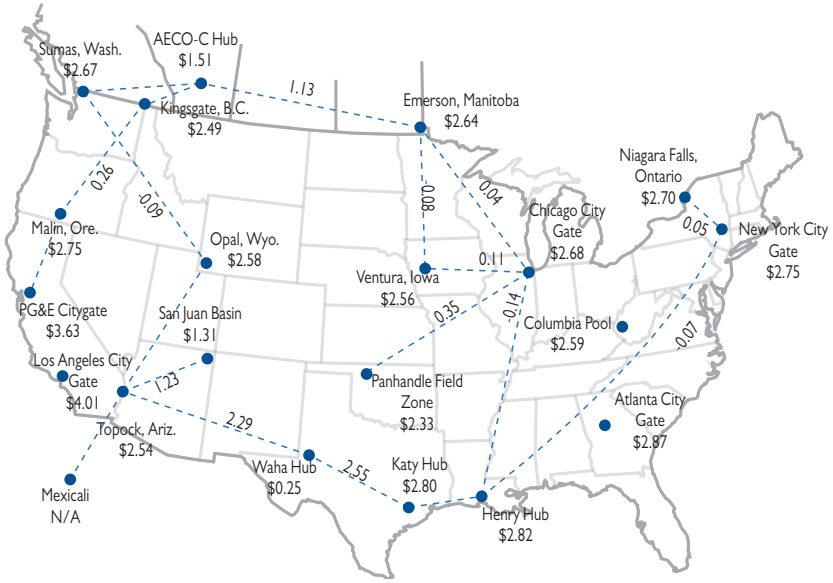
In an interview on the sidelines of CeraWeek, Ozden said it is important to remember that the oil and gas industry has been a pioneer in finding and then adapting new technologies such as AI and machine learning. He pointed out that just a few years ago, geologists and technicians would spend months studying data from a potential drilling site. "Now, that same work can be done in a matter of hours or a day."

The idea of robots and AI systems running refineries or gas processing plants "may be a bit overwhelming and may be what everyone looks at. But, the key element is and always will be the subject matter expert [SME] who can guide all of that data to the right place," Ozden said. "Otherwise, you just have all of this critical data floating around that no one knows how to use."

About five years ago. in the early days of this new era, the buzzword was "silos," or electronic storage sites where information could be stored, sorted and sent to the right person from either the drilling rig

Prices and Differentials for Major Hubs and Selected City Gates

March 25, 2019 — *(US$/MMBtu, Volume-Weighted)*



Selected Daily Differentials

Differential	3/18	3/19	3/20	3/21	3/22
HH-NY	-0.05	-0.15	-0.10	-0.03	-0.04
HH-Chicago	-0.13	-0.17	-0.15	-0.11	-0.11
AECO-CHIC	+1.15	+1.07	+1.78	+1.12	+1.01
AECO-PG&E	+1.97	+2.02	+2.86	+2.08	+1.90

or the C-suite. "The oil and gas industry is now looking at ways of taking huge amounts of data and then making sure that not only is it available to decision-makers in the upper levels but to everyone."

And helping guide that information flow, Ozden said, is the SME. Both he and al-Khowaiter agreed that the oil and gas industry must make changes to not only attract but retain this new-age workforce.

"We have to learn from other industries when it comes to keeping these new workers," al-Khowaiter said. That means attracting workers who might not want to come to an industry that has a reputation for slashing employees during the inevitable bust cycle.

That can mean working with students as early as middle school to cultivate an interest in the sciences, engineering and math and then carrying that through to college students, showing them that the oil and gas industry is indeed a good place to work.

"There has been some talk about the jobs that automation and digitalization might eliminate, but I think you will see that there are other jobs that are being created," Ozden said. "There will never be a day, I believe, when the human element is not the most important element when talking about this issue." ■

John Sullivan, Houston

Gas Seen as Primary Fuel to Trigger 'Hydrogen Society' in US, Elsewhere

The road to the "hydrogen society" will be paved by natural gas, industry executives agree, but there will be potholes to navigate along the way.

"I think that you will see hydrogen, at first, used mainly in transportation," said Hiroaki Osaki, president of Mitsubishi Heavy Industries America's (MHIA) Oil & Gas Division. Speaking to Energy Intelligence on the sidelines of the recent CeraWeek by IHS Markit conference in Houston, he said fuel cells for transportation are becoming more efficient and durable, making them more attractive to a heavy-duty vehicle market.

Hydrogen itself is not a primary energy source; most is currently produced from natural gas through a steam methane reforming (SMR) process. Hydrogen vehicles produce no emissions; they run on compressed hydrogen fed into a fuel-cell "stack" that produces electricity to power the vehicle in combination with an electric motor.

"But, to get there, there are still many engineering issues" that must be overcome, Osaki said.

One challenge will be finding the right technology that can produce enough hydrogen to supply all of the vehicles — and for that matter power generators — on an economically viable scale.

"The primary fuel, I believe, will continue to be natural gas," he said, noting gas' relative abundance and low cost since the shale boom began. "Gas will offer the world a new fuel in the way of hydrogen. I think you will begin seeing more interest in this from many different sides."

Syzygy Plasmonics CEO Trevor Best told Energy Intelligence that his company is developing technology to produce hydrogen from gas using a new reactor that does not require burning fuel like traditional methods. The Syzygy reactor instead uses a photocatalyst that was created by researchers at Rice University.

"Because we do not need to burn fuel, our reactor is able to reduce both cost and carbon emissions for the products that are created," he said. The Houston start-up company is preparing for field tests of its reactor unit — which is both scalable and easy transportable — by mid-2021.

Efforts to create technologies to produce hydrogen in quantities large enough to be economical are not new; they were tried in the 1970s and again in the 1990s, but the process was too expensive.

Best said that the fuel cells being created now are better, more efficient and cheaper than the ones tried in earlier decades. "Outside of fuel cells, developing hydrogen infrastructure has depended on four areas: production, compression, storage and transportation," he said.

Advances in compression and storage have been made, but

North American Weekly Gas Storage

(Billion Cubic Feet)

Region	Week Ending Mar. 15	Week Ending Mar. 8	% Full	1 Week Chg.	Year Ago	1 Yr Chg.	5 Yr Avg.	5 Yr Chg.
US								
East	245	262	22.2	(17)	276	(31)	310	(65)
Midwest	268	287	21.9	(19)	320	(52)	374	(106)
Mountain	62	66	13.1	(4)	90	(28)	115	(53)
Pacific	96	102	23.2	(6)	169	(73)	200	(104)
South Central	471	473	30.2	(2)	603	(132)	699	(228)
Total Lower 48	**1,143**	**1,190**	**23.9**	**(47)**	**1,458**	**(315)**	**1,699**	**(556)**
Canada								
East	52	57	18.4	(6)	86	(34)	86	(34)
West	216	221	44.3	(5)	290	(74)	263	(47)
Total Canada	**268**	**278**	**34.8**	**(11)**	**376**	**(108)**	**349**	**(81)**
Total North America	**1,411**	**1,468**	**25.5**	**(57)**	**1,834**	**(423)**	**2,048**	**(637)**

Sources: US-EIA. Canada-Enerdata. Values in Bcf unless otherwise noted.